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ROYAL BOTANIC GARDENS. KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 9.] [1912.

LI.—NEW SOURCES OF PAPER.

(*Hedychium coronarium*, Koen., and allies.)

(With Plates.)

Early in the present year Messrs. Clayton Beadle and Stevens, of London, drew the attention of Kew to the value of *Hedychium coronarium* as a source of material for paper-making.

This plant, a member of the Natural Order *Zingiberaceae*, is a native of India, being distributed from the Himalayas to Ceylon and Malacca, ascending to 4000 ft. in the Khasia Hills and 6000 ft. in Ceylon. It is also recorded from Central America, the West Indies, New Zealand, Mauritius and West Africa (Corisco Bay). Many years ago it appears to have been introduced into Brazil and it has run wild in many of the States, being especially abundant at Morrettes in the State of Parana, where it has covered a large tract of swampy country.

The plant in its naturalised condition in Brazil is shown on Plate I. When the introduction to Brazil took place is uncertain. There is a specimen at Kew collected by Dr. Glaziou in 1869 and the presence of the plant in Brazil is recorded by Martius* and K. Schumann.† These authors mention that the plant is known by the native names "Lagrimo de Moçá" and "Escaldamão." According to some Portuguese documents quoted by Messrs. Clayton Beadle and Stevens the plant is sometimes known in Brazil as wild Jasmine.

The genus *Hedychium*, of which a good description by Baker is to be found in Hooker's Flora of British India, vol. vi., p. 225, is characterised by the horizontal tuberous rootstock, which bears the erect elongated leafy stems. The leaves are distichous, oblong or lanceolate, with long clasping sheaths. The inflorescence forms a terminal spike.

* Martius, Flor. Bras. III., iii., 37.

† K. Schumann, Pflanzenreich (Zingiberaceae), pp. 44 and 56. *See also* Usteri, Flora der Umbegung der Stadt São Paulo (1911), pp. 169, 170.

(26866—6a.) Wt. 189—806. 1125. 12/12. D & S.

H. coronarium is best distinguished from other species of the genus by the following characters :—Inflorescence ellipsoid or ovoid ; 3–5-flowered bracts which are densely imbricate in 5–8-spirals. Staminodia oblong-lanceolate, white. Labellum widely obcordate, white with yellow sometimes near the base. Filament white.

At Kew the plant thrives under tropical swamp conditions in House No. 15 and is an object of beauty throughout the summer and autumn with its spikes of fragrant white flowers. The photograph reproduced on Plate II. is taken from one of the Kew plants, and the numerous, closely-arranged leafy stems springing from the creeping rhizomes can be well seen. At Kew the stems attain a height of about 3–4 feet. In Brazil the plant is described as growing spontaneously and thickly and completely covering the land. The stems are said to reach a height of 1–1½ metres when growing thickly and to be about 2–4 cm. in thickness. On the margins of streams, however, the stems grow as high as 2 metres. After cutting down the stems it is found that some 4–5 months must elapse before a full growth of fresh stems is made.

In order to make certain of the identity of the Brazilian plant whose paper-making qualities had been tested, application for specimens was made to H.M. Consul at São Paulo for specimens of the plant. Thanks to the kind services of the Acting Consul and H.M. Vice-Consul at Curityba, a specimen of the plant known in that region as *Hedychium coronarium* has been received at Kew. This proved to be *Hedychium coronarium*, as did also the specimens sent to Kew by Messrs. Clayton Beadle and Stevens from Parana.

The value of the plant for paper-making was brought to our notice in a request for fresh material for the purpose of experimental investigation. Messrs. Beadle and Stevens had already satisfied themselves as to the good qualities of Hedychium fibre from the dried material they had received from Brazil, and were naturally anxious to test it in the green fresh condition. The paper-making qualities of the fresh material supplied from Kew were found to be identical with those of the dried stems, and the plant appears likely to be a very valuable source of material for the paper-maker.

In a letter to Kew, Messrs. Clayton Beadle and Stevens write:—

"Papers produced from this fibre have even greater tensile strength than the strongest manila papers produced. The strongest manila papers have a strength of 6000 or 7000 metres 'breaking length.' This paper has from 9000 to 10,000. Its elasticity and folding qualities are exceptional. Moreover, it can be made to bear ink and possess parchment qualities without any sizing or other special treatment.

"The reason of this we find to be due to the presence of the cells associated with the fibre, which are of a semi-gelatinous nature, when chemically treated, and dry into the interstices of the paper and produce natural parchment."

Messrs. Clayton Beadle and Stevens recently presented a paper to the Eighth International Congress of Applied Chemistry* on

* The paper-making qualities of *Hedychium coronarium* represented from Original Contributions, Eighth International Congress of Applied Chemistry, vol. xiii, pp. 39–45.

I.—Hedychium Coronarium in Brazil.

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II.—Hedychium Coronarium at Kew.

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the paper-making qualities of *Hedychium coronarium* and the following extracts are taken from a copy of the paper sent to Kew by the courtesy of the authors.

A chemical analysis of dried specimens as received was made with the following results :—

"A. Whole stem as gathered.
B. Whole stem after passing through crushing-rollers.

	A	*B*
Moisture	9·7%	11·2%
Ash	4·5	4·8
Cellulose	43·0	48·0
Extracted by chemical treatment	42·8	36·0
	100·0	100·0
Cellulose air dry on air dry allowing for losses...	41·0%	44·0%

"Raw material in the form of B is conveniently treated by boiling with 5 per cent. of soda at a pressure of three to five atmospheres. On washing this material, the yield of boiled product including all the fibrous constituents of the plant is 60 per cent. The peculiar characteristics of the pulp are largely due to the presence of the oval cells of the pith, which is included in the above 60 per cent. If these are removed by washing, the yield of fibre proper is 50 per cent. of unbleached material on the raw weight.

"We discovered that the pith cells, which can be retained or not, according to requirements, possess very peculiar qualities. If taken alone, the unbleached cells when dried down go to a horny mass which can only be broken with very great difficulty with a hammer, and are softened only with difficulty when boiled in soda. If retained in the paper, they give it parchment-like properties to an extraordinary degree. They also render the paper ink-bearing without the addition of any sizing material. . . . . On the other hand, the paper made from *Hedychium* from which the cells are removed is of a soft nature and of medium strength, but that in which the cells are retained, as will be seen, gives higher 'breaking lengths' than any manila paper that we have so far had the opportunity of examining. The oval cells, therefore, 'parchmentize,' strengthen and size the sheet.

"The pulp, after boiling in soda and beating, if examined under the microscope in the presence of chloriodide of zinc shows :—

(*a*) Oval cells stained blue.
(*b*) Long wide fibres something like chemical wood, stained blue.
(*c*) Numerous shorter and solid-looking fibres, stained yellow.
(*d*) Small epidermal cells attached to one another, stained yellow."

The length of fibres is given in a table which is not reproduced here. The means of the results of measurements under the microscope of numerous fibres are as follows :—

"1. Hedychium fibres, unbleached, not beaten, 2·61 mm.
"2. Hedychium bleached, not beaten, 2·56 mm.

"3. Hedychium cells washed through 70-mesh wire, measured lengthwise, 0·138 mm.

"4. Hedychium cells washed through 70-mesh wire, measured crosswise, 0·083 mm

"5. Best strong thick manila cable paper, 2·835 mm.

"6. Ditto, thin, 2·89 mm."

"It will be observed that the mean size of the cells, taking the mean of the two directions [mean of 3 and 4], is 0·11 mm., or less than 1/20 of the length of the fibres which measure 2·58. It can be understood, therefore, that such small particles as the oval cells will pass through a 70-mesh sieve of the washing drum, the holes of which would be about 0·2 mm., but the same sieve would of course retain the fibres proper. It will be observed also that the mean length of the fibres of the longest and strongest manila papers, which is about 2·85 mm., is only slightly in excess of that of the *Hedychium* fibre, but, as will hereafter be seen, the *Hedychium*, on account of the peculiar nature of the fibres and the cells, is capable of producing a stronger and in many respects more serviceable paper. Moreover, the smallness of the *Hedychium* cells in comparison with the fibres enables the cells to fill the interstices between the fibres. Moreover, these cells, being of a flocculent, sticky and glutinous nature, act as a natural sizing material. We mechanically separated and weighed the cells and fibres with the following results :—

"The actual amount of fibre proper and cells in *Hedychium* unbleached paper, the cells of which have been entirely retained, we find to be as follows :—

Cells	...	...	17·3%
Fibre	...	...	82·7

"When the pulp is completely bleached so as to produce a white paper, the proportion by weight of cells and fibres in the finished paper is as follows :—

Cells	...	...	14%
Fibre	...	...	86

"We have made several trials of this material on the paper machine. The beaten fibre, especially that containing the pith cells, when left in an unbleached condition, has an extremely greasy feel, enough to lead one to suppose that it would only part with its water with very great difficulty on the paper machine. Unlike most greasy feeling pulp, however, the water drains from the machine wire with great rapidity. We have seen the pulp on the wire of the paper machine on five or six occasions. In one case, when making a parchment paper, we observed that the water left the wire quickly after the apron—in fact, in one-quarter of the space taken by a wood-pulp paper made on the same machine at the same speed. This argues in favour of the possibility of comparatively fast running on the paper machine, in spite of the greasy feel and the parchment-like qualities.

"For the purpose of making a comparison of papers producible from the *H. coronarium* with papers with which it is likely to come into competition, we carried out a number of tests as to strength,

breaking strain, elongation, bursting strain and greaseproof qualities. These are contained in Table B [not reproduced].

"We draw attention to this fibre as we believe it may become of great industrial importance to the paper trade. Where circumstances are congenial to its growth, the plant spreads to the exclusion of all other vegetable growth by means of its rhizomes, so that it can be harvested at least once a year, producing a heavy crop. It is an easy pulp to manipulate. It is capable of producing a paper of exceptional strength and can be worked either bleached or unbleached. The fact that the paper in its natural state, without the addition of any materials whatever, can be made to possess greaseproof and self-sizing qualities is a point of commercial importance."

Messrs. Clayton Beadle and Stevens also inform us that they have dressed some of the fibre from the green stem, and the tensile strength tests indicate that it is almost exactly similar in strength to the best pure manila binder-twine. Samples both of the paper and the fibre have been presented to Kew and have been placed in the Museum.

Owing to the very remarkable paper-making qualities of *Hedychium* and the ease with which the plant spreads under favourable conditions in the tropics, it seems likely that it may be in considerable demand in the near future.

Amomum and Alpinia.

As *Hedychium* has proved to be so valuable a plant for paper-making, stems of *Amomum hemisphericum* and *Alpinia nutans* have also been submitted to Messrs. Clayton Beadle and Stevens for examination as to their paper-making qualities.

In the accompanying report they mention that in neither case do these plants yield papers showing the self-sizing qualities to be observed with *Hedychium* and under certain conditions also with manila waste, bagasse, and also with banana fibre. The Report is as follows :—

"These plants were passed through sugar-crushing rollers for the removal of juices and to reduce same to the condition of tow. They were then boiled under pressure, each with 20 per cent. of soda, the *Amomum hemisphericum* being boiled for 4 hours at 40 lbs. pressure and the *Alpinia nutans* for 6 hours at 50 lbs. They were afterwards bleached, and the yield of unbleached and bleached fibres expressed on the original green weight of stem as received, as follows :—

On green stem as received.		*Amomum.*	*Alpinia.*
Yield—unbleached	...	7·44%	5·93%
bleached	...	6·36	4·95

"If expressed upon the dry weight of stem the figures are as follows :—

On dry stem.		*Amomum.*	*Alpinia.*
Yield—unbleached	...	58·2%	50·0%
bleached	...	49·6	41·5

"The average length of unbeaten fibres as contained in each of the pulps taken as an average of 10 measurements was measured with the following results:—

	Amomum.	*Alpinia.*
Length of fibre	2·54 mm.	2·21 mm.

"From a superficial examination of the pulps in each case we think it possible that the *Amomum hemisphericum* could be made to produce a strong brown paper with a long tear. It is also capable of being bleached white. Very much the same remarks may be said to apply to the *Alpinia nutans*."

From Messrs. Clayton Beadle and Stevens' report it would appear that *Amomum* and *Alpinia*, though considerably inferior to *Hedychium*, might nevertheless be quite useful sources of material for the paper-maker. *Amomum hemisphericum* is a native of Java. *Alpinia nutans* is recorded from Hong Kong, Formosa, Cochin China, the Eastern Himalaya and the Malay Peninsula. It is also known from the West Indies, Guatemala, Venezuela, Surinam and Brazil, but like *Hedychium* it has probably been introduced into the Western Hemisphere.

Both *Amomum* and *Alpinia* belong to the Natural Order *Zingiberaceae*. Their habit of growth is quite similar to that of *Hedychium*, and it seems probable that *Alipinia* would form dense thickets in swampy country. The stems of *Amomum* reach a height of as much as 16 feet, and those of *Alpinia* are stated to attain to 8 to 10 feet in height.

LII.—AKANIACEAE: A NEW FAMILY OF SAPINDALES.

O. Stapf.

The position of the genus *Akania* has been much contested and no satisfactory suggestion has so far been made as to its proper place in the Natural System. *Akania* was described by J. D. Hooker in Bentham and Hooker's Genera Plantarum, vol. i. p. 409 (1862) and placed in *Sapindaceae* at the end of the suborder *Sapindeae* without any further observation. Bentham in Flora Australiensis, vol. i. p. 471 (1863) followed Hooker, adding that *Akania* was "allied to *Harpullia* but very different in the calyx and disk." This remark was probably occasioned by F. v. Mueller's suggestion that the plant which he had then just described as *Cupania lucens* (Fragm. Phyt. Austr. vol. iii. p. 44; 1862) may be a *Harpullia*. Baillon, in his Histoire des Plantes, vol. v. (1874) also has *Akania* in *Sapindaceae* "as the type of a small isolated subseries" and as a "perigynous Sapindacea" (p. 357), but as a doubtful member of the Order (p. 412). He had, however, not then seen the plant. When a few years later he received flowering material from the botanic garden at Hamma, Algeria, he pointed out that its relationship was with *Xanthoceras* which in his opinion connected the *Sapindaceae* with the *Staphyleaceae*. This met halfway F. v. Mueller's view, expressed in 1875, in the 76th fascicle of his Fragmenta Phytographiae Australiae,

(vol. ix, p. 90), that *Akania* was referable to the "*Staphyleae*" in spite of its alternate leaves and the absence of stipules. In 1890, Radlkofer discussed at some length the relationship of *Akania* in his paper "Gliederung der Sapindaceen" in Sitzungsber. d. k. Bayersch. Ak. d. Wiss. Band xx. p. 127–138, and pronounced for *Staphyleaceae*, but with this admission that the genus represented an anomalous type of that order, the anomaly being in the alternate estipulate leaves, the perigyny of the flowers, the diplostemony of the androecium, the pendulous, epitropous ovules and certain anatomical characters. Solereder in Berichte der Deutschen Botanischen Gesellschaft, Band x. (1892), p. 551, came to the same conclusion and established a tribe *Akanieae* of *Staphyleaceae* which apart from *Akania* also included *Huertea* and *Tapiscia*. His argument rests mainly on anatomical and seed characters; but even so the new tribe cannot be considered as sufficiently homogeneous. In fact, Pax in his monograph of the *Staphyleaceae* in Engler u. Prantl's Natürliche Pflanzenfamilien (Teil iii. Abt. 5. p. 259; 1893), while accepting *Tapiscia* and *Huertea* as the representatives of a distinct tribe (*Tapiscioideae*) of *Staphyleaceae*, felt obliged to reject *Akania* not only from that tribe but from the family, relying on the alternate arrangement of the leaves, the absence of stipules and especially the diplostemony of the androecium, the number of ovules in each cell and their pendulous, epitropous orientation.

Excluded by Radlkofer from *Sapindaceae* and by Pax from *Staphyleaceae*, *Akania* remained "incertae sedis" and was enumerated and described as such by Harms in Nachträge zum ii.–iv. Teil of the Natürliche Pflanzenfamilien (1897), p. 331. Solereder in his Systematische Anatomie der Dicotyledonen (1898), pp. 275, 276 (Engl. transl. 1908, pp. 242, 243), adheres to his view expressed in 1892, but without adducing new reasons or discussing the views put forward by Pax. Since then no further contribution on the subject has appeared. I myself examined the dried material at Kew some years ago without arriving at any result except the negative one that *Akania* agreed neither with *Sapindaceae* nor with *Staphyleaceae*.

The fact that in the present year a specimen of *Akania Hillii* flowered in the Temperate House at Kew and that the plant was selected for figuring in the Botanical Magazine induced me to take the matter up once more in order to see whether a place in the system could not be found for this stray genus.

The descriptions which we possess of the structure of *Akania* are neither in an exact agreement nor are they quite correct.

The original description by J. D. Hooker is erroneous in two points of importance, namely as to the character of the aestivation of the corolla and the number of the stamens. Hooker described the petals as imbricate, and this statement is repeated in Baillon, Histoire des Plantes (vol. v. p. 412) and in the Natürliche Pflanzenfamilien (Nachträge, p. 331). Baillon, however, in 1878 pointed out (in Bull. Soc. Linn. Paris, i. p. 224), that he found the corolla contorted in all the flowers he examined of the specimen which he received from Hamma, and this is also my experience from herbarium specimens as well as from the fresh material at Kew.

The number of stamens, varies from 8 to 9, but is usually 8, and I never observed 5 or 10. The gaps in the androecium are always in the inner whorl, but their positions are not constant.

The contorted aestivation adds to the characters which tend to exclude *Akania* from the *Sapindaceae* as well as from the *Staphyleaceae*. But if neither *Sapindaceae* nor *Staphyleaceae* are available to receive *Akania*, where is it to be placed? No other family has been suggested, and yet it is abundantly clear that the affinity lies with the *Sapindales*, Benth. and Hook. f. or *Sapindales-Sapindineae*, Engl., in which subseries it occupies an isolated position, comparable to that of the small families of the *Hippocastanaceae* and *Aceraceae*, although more detached than either. This means, to express the condition taxonomically, that *Akania* represents a distinct family in the subseries of the *Sapindineae*, the appropriate name for which would be *Akaniaceae* and its diagnosis as follows :—

Akaniaceae, *Stanf* (fam. nov.); ex affinitate *Sapindinearum*, a caeteris familiis subseriei distincta petalorum aestivatione contorta, disci absentia et endospermo amplo.

Flores hermaphroditi, actinomorphi, receptaculo magis minusve hemisphaerico haud alto. *Calyx* inferus, sepalis 5, eutopice imbricatis, secundo axin versus spectante, paulo inaequalibus. *Petala* 5, aequalia, dextrorsum vel sinistrorsum contorta, in receptaculi margine inserta. *Discus* nullus. *Stamina* fere semper 8 (raro 9), quorum 5 externa episepala in medio receptaculo, caetera vero circa ovarii basin inserta; filamenta elongata, filiformia; antherae oblongae, basifixae, basi breviter bilobae. *Ovarium* integrum, 3-loculare; stylus simplex, rectus, filiformis; stigma minute 3-lobum. Ovula in quoque loculo 2, superposita, anatropa, pendula, raphe adaxiali, micropyle supera, integumentis 2. *Fructus* capsularis, loculicide valvis 3 coriaceo-lignosis dehiscens. *Semina* exarillata, globoso-ovoidea, testa crustacea; endospermum carnosum, amplum, cotyledonibus accumbens. *Embryo* amplus, rectus; cotyledones transversae, crassae, subplanae; radicula superior, brevissima, recta.

Arbores. *Folia* alterna, exstipulata, imparipinnata, coriacea. *Inflorescentiae* paniculatae.

LIII.—DECADES KEWENSES

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECADES LXVII.—LXIX.

661. **Delphinium Purdomii**, *Craib* [Ranunculaceae-Helleboreae]; a *D. trichophora*, Franchet, cui affinis, petalorum lateralium lobis 5 mm. longis 1 mm. latis recedit.

Bracteae lanceolatae, acutae, 2·7 cm. longae, 6 mm. latae, supra fere glabrae, infra sparse villosae, longe ciliatae, 8 mm. infra apicem dente solitario latere utroque instructae; bracteolae 2, 5 mm. inter se distantes, parte superiore pedicelli affixae, oblongo-lanceolatae, integrae, 1·4 cm. longae, 4 mm. latae, indumento ut bracteae;

pedicelli erecti, rachidi adpressi, infimi 14 cm., intermedii 6·5 cm. longi, pilis albis divergentibus instructi. *Sepalum* posticum late ellipticum, acuminatum, 2·3 cm. longum, 2 cm. latum, intra glabrum, extra pilis longiusculis instructum; calcar rectum, 2 cm. longum, validiusculum; sepala lateralia 1·8 cm. longa, 1·2 cm. lata, indumento ut posticum sed praecipue medio marginibusque; infima 1·7 cm. longa, 1 cm. lata, indumento postici. *Petala* postica 3 cm. longa, apice bifida; lateralia apice biloba, lobis ad 5 mm. longis et 1 mm. latis barbatis. *Filamenta* summo apice glabra, paulo inferius pilis longiusculis divergentibus instructa, dein complanata, basi 1·25 mm. lata. *Ovaria* 3, villosa; stylus glaber, apice bifidus.

China. Kansu: Minchu, 2400 m., *Purdom*, 142, cult. Hort. Veitch.

662. **Tetracera Havilandii**, *Ridl.* [Dilleniaceae]; species *T. axillari*, Martelli, affinis, haud sericea autem atque foliis diversa, a *T. Radula*, Martelli, differt sepalis aequalibus marginibus exceptis glabris.

Frutex scandens. *Folia* obovata, apice rotundata vel emarginata, basi cuneata, in petiolum decurrentia, coriacea, 12 cm. longa, 7 cm. lata, scabrida, costa superne depressa hirta, capillis appressis; petioli breves, complanati, marginibus hirti. *Paniculae* parvae, ramis pilis stellatim patentibus munitis. *Sepala* sub fructu subaequalia, ovata, glabra, scabra, marginibus ciliatis. *Carpella* 3, ovata, apiculata, nitida, 3 cm. longa.

Sarawak. Kuching, Oct. 8, 1892, *Haviland*, in Herb. Kew.

663. **Tetracera scabricaulis**, *Ridl.* [Dilleniaceae]; species *T. Radula*, Martelli, proxima, sed caule insigniter scabrido, foliis oblongis obtusis basibus rotundatis, ramis paniculae pilis stellatis munitis differt.

Frutex scandens, caule validulo ligneo, primo scabrido, pilis brevibus rigidis mox pilis delapsis pustuloso-scabrido. *Folia* oblonga, obtusa, basi rotundata, apice, obtusa, 10 cm. longa, 4 cm. lata, marginibus inter apices nervorum sinuatis, coriacea, superne atque inferne scabra, nervis 7-jugis subtus elevatis, costa superne depressa, hirta (folia juvenilia superne hirta, pilis dissitis rigidis pallidis); petioli scabridi, complanati, atri, 5 6 mm. longi. *Paniculae* 10–14 cm. longae, basi ad medium nudae, ramis paucis brevibus scabridis hirtis, rachi pilis brevibus stellatis munito. *Flores* copiosi. *Bracteae* oblongae, obtusae, 5 mm. longae, pedicellos superantes, extus hirtae, marginibus dense ciliatis. *Sepala* exteriora ovata, orbicularia, rotundata, interiora magis oblonga, sericeo-pubescentia, marginibus ciliatis, subtus in centro sericea, 5 mm. longa, 3 mm. lata. *Petala* tenuia, glabra, paullo longiora. *Stamina* breviuscula, apicibus sub-obtriangularibus, saepe inacquilateralibus. *Styli* et carpella 3.

British North Borneo. Sandakan, *Creagh.*

664. **Talauma Beccarii**, *Ridl.* [Magnoliaceae]; species *T. Candollei*, Bl., affinis, foliis glabris, nervis numerosioribus petalisque longioribus et latioribus differt.

Frutex ramis pallidis, alabastris et apicibus ramorum hirtis, capillis flavis. *Folia* oblanceolata, cuspidata, 18 cm. longa, 5 cm. lata, glabra, coriacea, nervis 14-jugis, intra marginem arcuatis, reticulationibus in utroque latere conspicuis; petioli 2 cm. longi, ad basim

subito incrassati. *Petala* lata, oblonga, obtusa, apice rotundata, 4 cm. longa, 1·5 cm. lata. *Stamina* linearia, acuminata, acuta, 1·5 cm. longa. *Syncarpium* acuminatum, supra apices staminum serecio-lanuginosum, 3 cm. longum, 1 cm. latum, apicibus carpellorum glabris obtusis.

Sarawak. *Beccari*, 3959.

Very distinct from what I take to be the true *T. Candollei*, Bl., in the narrower leaves more plainly reticulated, and the petals longer, and broader in proportion to their length.

665. **Uvaria cauliflora**, *Ridl.* [Anonaceae]; species sine dubio *U. purpureae*, Bl., affinis, differt toto coelo inflorescentia, quae paniculata est atque e caule lignoso exorta, foliis fere glabris et versus apicem latioribus versus basin attenuatis, calyce in flore expanso irregulariter disrupto.

Frutex scandens, partibus juvenilibus ferrugineo-tomentosis. *Folia* tenuiter coriacea, obovata, oblanceolata aut elliptica, apice saepe abrupte cuspidata, versus apicem latiora, ad basim obtusam attenuata, 13–24 cm. longa, 5–9 cm. lata, cuspide 1 cm. longo, nervis 13-jugis tenuibus, costa decidue ferrugineo-tomentosa, aliter glabra; petioli crassi, transversim rugosi, 5 mm. longi. *Flores* racemosi aut paniculati, ramis paniculae 5–12 cm. longis validis, rufo-tomentosis; bracteae persistentes, lanceolatae, obtusae, rigidae, rufo-tomentosae, 5–7 mm. longae. *Alabastra* ovoidea, 2 cm. longa, pedicellis bibracteatis 2–5 cm. longis. *Calyx* ovoideus rufo-tomentosus aut farinosus, irregulariter disruptus. *Petala* oblongo-ovata, extus farinosa, intus glabra, 7 mm. longa, 5 mm. lata. *Stamina* lineari-oblonga, 2 mm. longa, appendice complanato quadrangulari. *Torus* hemisphaericus. *Carpella* plura, truncata, stigmatibus brevibus. *Ovula* 6–9 in loculo.

Sarawak. Tegora, *Haviland*, 417; foot of Bembang, *Haviland*, 409; *Beccari*, 1120.

The leaves of Beccari's specimen are smaller, more coriaceous and elliptic, but it resembles otherwise Dr. Haviland's fine series.

666. **Uvaria lanuginosa**, *Ridl.* [Anonaceae]; ab *U. parviflora*, Hook. f. et Thoms., foliis et ramis tomento aurantiaco-rufo tectis distincta.

Caules, folia, flores tomento aurantiaco rufo undique tecti. *Folia* elliptica, cuspidata, versus basin rotundatam attenuata, 14 cm. longa, 5 cm. lata, nervis 7–8-jugis intra marginem arcuatis; petioli 1·2 cm. longi. *Flores* parvi, "pallidi," in racemis extra-axillaribus; pedicelli 5 mm. longi; bracteae ovatae vel ovato-lanceolatae, obtusae, 5 mm. longae. *Sepala* ovata, obtusa, 5 mm. longa. *Petala* oblonga, obtusa, versus apicem dilatata, 1 cm. longa. *Stamina* breviuscula, oblonga, appendicibus majoribus. *Carpella* pauca, hirta. *Ovula* in seriebus 2, circiter 16.

Sarawak. Near Kuching, *Haviland and Hose*, 334.

"Petals pale."

667. **Artabotrys Havilandii**, *Ridl.* [Anonaceae]; species *A. polygyno*, Miq. et *A. hamato*, Bl., affinis, floribus in unco complanato tomentoso majusculo, ramis pluribus brevibus; petalis lanceolatis hirtis, carpellis ovoideis breviter rostratis distincta.

Frutex scandens, ramis brunneis vel nigris longitudinaliter rugosis, partibus juvenilibus hirtis. *Folia* coriacea, adulta glabra, elliptica, acuminata, basi cuneata, in petiolum decurrentia, 12 cm. longa, 4 cm. lata vel minora, nervis 7-jugis in utroque latere elevatis gracilibus irregulariter anastomosantibus; petioli 1 cm. longi vel breviores. *Flores* in uncis validis complanatis (juvenilibus rufo-tomentosis) in ramis pluribus brevibus; bracteae ovatae, 2 mm. longae, rufo-tomentosae; pedicelli hirti, 0·5 1 cm. longi. *Sepala* ovata, triangularia, acuta, cuspidata, rufo-tomentosa. *Petala* lanceolata, obtusa, supra basim vix angustata, in utroque latere hirta, 1·5 cm. longa, 5 mm. lata; interiora angustiora. *Stamina* pauca, appendicibus majusculis rotundatis albescentibus. *Carpella* circiter 10, juvenilia clavata, rugosa, matura ovoidea, ad basim angustata, apicibus breviter rostratis, 2 cm. longa, 1 cm. lata.

Sarawak. Kuching, *Haviland*, 1629, 3340; *Beccari*, 381, 786, 713, 554.

668. **Artabotrys hirtipes**, *Ridl.* [Anonaceae]; species *A. hamato*, Bl., affinis, pedicellis bracteis sepalisque pilis rufis tectis foliis coriaceis glabris differt.

Frutex ramis nigris pilis brevibus rigidis tectis. *Folia* coriacea, glabra, elliptica, longe cuspidata (cuspide 1 cm. longo), basi paullo attenuata, 10 cm. longa, 3–5 cm. lata, nervorum 9-jugis ad apices arcuatis reticulationibus conspicuis, petiolis 6 mm. longis. *Flores* magni; pedicelli pilis rufis tecti, 1 cm. longi; bracteae ovatae, acuminatae, pilis longis rufis tectae. *Sepala* ovata, lanceolata, acuminata, 5 mm. longa, pilis rufis tecta. *Petala* externa lanceolata, obtusa, carinata, tomentosa, basibus paullo dilatata, supra excavationem haud angustata, 2·5 cm. longa, 1 cm. lata ubi latissima; petala interiora angustiora et breviora. *Stamina* pauca, glabra, appendicibus majoribus. *Carpella* subcuneiformia, apicibus latis complanata, 2 cm. lata, tomentosa.

Sarawak. Rejang Kapit, *Haviland*, 2326; Kuching, *Haviland*, 2106, in fruit.

The Kuching plant has more coriaceous leaves, 15 cm. long and 6 cm. across and stouter pedicels than the other specimen.

669. **Polyalthia coriacea**, *Ridl.* [Anonaceae]; arbor *P. congregatae*, King, affinis, sed foliis distincte petiolatis rigidioribus floribus minoribus breviter racemosis in trunco sitis.

Arbor parva. *Folia* coriacea, glabra, costa utroque latere et nervis subtus hirtis exceptis, elliptica, obtusa vel oblonga, breviter acuminata, 21–42 cm. longa, 10–16 cm. lata, basi late rotundata, nervis paribus 20 superne depressis subtus elevatis parallelis, nervulis transversis parallelis, petioli validi, 1 cm. longi dense hirti. *Flores* caulini in racemum brevem dispositi; pedunculus validulus, hirtus, 1 cm. longus vel minor; bracteae ovatae, omnes rufo-hirtae; pedicelli 2–3 cm. longi. *Sepala* triangularia, acuta vel acuminata, extus tomentosa, 6 mm.–2 cm. longa. *Petala* flava vel lactea, oblonga, obtusa, 4 cm. longa, 1 cm. lata. *Torus* semiovoideus, hirtus. *Pistilla* hirta. *Carpella* matura cylindrica, breviter rostrata pedicellata, velutinosa, 4 cm. longa, 2 cm. lata.

Sarawak. Mt. Buan, Limestone. *Haviland*, 2002; Bidi, *C. J. Brooks*, 1057.

Brooks' plant differs from Haviland's in its much larger leaves shortly acuminate at the tip, and larger distinctly acuminate sepals, but I have little doubt that they both belong to the same species.

670. **Polyalthia erianthia**, *Ridl.* [Anonaceae]; species affinis *P. oblongae*, King, floribus multo majoribus dense sericeo-lanuginosis, foliis ellipticis acuminatis majoribus subtus pubescentibus, nervorum paribus 9–10, nervulis parallelis differt.

Arbor, partibus juvenilibus lanuginoso-hirtis flavescentibus. *Folia* elliptica, acuminata, basi angustata, 20–30 cm. longa, 8–10 cm. lata, tenuiter coriacea, superne glabra, subtus minute pubescentia, nervis tenuibus superne inconspicuis subtus elevatis 9–10-jugis, nervulis parallelis, reticulationibus tenuibus; petioli crassi, pubescentes, 1 cm. longi. *Flores* singuli, axillares, omnino velutino-lanuginosi (staminibus exceptis), pedicellis crassis 7 mm. longis suffulti; bracteae ovatae. *Sepala* ovata, obtusa, 7 mm. longa. *Petala* externa ovata, lanceolata, obtusa, 2 cm. longa, 1 cm. lata; interna minora, angustiora. *Stamina* copiosa, appendicibus rotundatis. *Carpella* hirta.

Sarawak. Five miles from Kuching, *Haviland*, 410.

671. **Disepalum grandiflorum**, *Ridl.* [Anonaceae]; frutex *D. anomalo*, Hook. f., affinis, floribus majoribus petalis longioribus, internodio inter calycem et corollam distincto differt.

Frutex ramis pallidis. *Folia* elliptica, cuspidata vel ovata, basibus angustatis cuneata, 8–13 cm. longa, 5–5·2 cm. lata, tenuia, glabra, nervis gracillimis 8-jugis; petioli 5 mm. longi. *Flores* singuli, foliis summis oppositi; pedicelli ebracteati, graciles, 3 cm. longi. *Sepala* 2, ovata, obtusa, deflexa, 1 cm. longa, 8 mm. lata. *Corolla* 2 mm. supra calycem inserta; petala rufo-hirta, basi in cupulam connata, 2 cm. longa, 1 cm. lata; lobi 7 mm. longi. *Stamina* copiosa, appendicibus orbicularibus convexis.

Sarawak. Baram, *Hose*, 142; Marudi, *Hose*, 214.

672. **Unona jambosifolia**, *Ridl.* [Anonaceae]; frutex *U. Wrayi*, Hemsl., affinis, foliis magnis ellipticis basi cordatis subpeltatis fere sessilibus, nervis 10-jugis procul a marginibus arcuatim anastomosantibus, floribus binis, petalis crassiusculis subaequalibus ovato-lanceolatis, ovulis in ovario 1–4, seminibus 1-4 pro carpello.

Frutex. *Folia* subcoriacea, glabra, subtus pallida vel rufescentia, lanceolata vel elliptica, acuminata, basi rotundata vel cordata, subpeltata, 17 cm. longa, 5–7 cm. lata, nervis superne depressis 10-jugis 5 mm. a folii margine regulariter arcuatim anastomosantibus; petioli 2–4 mm. longi, crassi, hirti. *Flores* bini, in parte inferiore rami positi; pedicelli pubescentes, 1 cm. longi. *Sepala* semi-orbicularia, crassa, pubescentia, pilis rufis ciliata. *Petala* subaequalia, ovata, lanceolata, oblonga, 1 cm. longa, 6 mm. lata, crassiuscula, pilis rufescentibus marginalibus exceptis glabra. *Stamina* plurima, appendicibus latis complanatis angulatis. *Pistilla* hirta. *Carpella* matura circiter 14, globosa vel cylindrica, 10 cm. longa, 7 mm. lata, hirta, breviter rostrata, stipitibus 7 mm. longis. *Semina* 1–4.

British North Borneo. Batu Putik, *Creagh;* Kudat, *Fraser*.

673. **Unona conchyliata**, *Ridl.* [Anonaceae]; frutex *U. Wrayi*, Hemsl., affinis, petalis brevioribus et minoribus, obtusis, interioribus latioribus costatis, floribus in ligno vetusto singulis differt.

Frutex, cortice pallido. *Folia* elliptica, cuspidata, basi rotundata, 10–18 cm. longa, 4–5 cm. lata coriacea, glabra, nervis 9-jugis, nervis secundariis fere aeque conspicuis, reticulationibus in pagina utraque elevatis ; petioli crassi, transversim rugosi, 5 mm. longi. *Flores* in ligno vetusto singuli ; pedicelli 1 cm. longi, sub fructu incrassati. *Sepala* ovata, acuta vel obtusa, 1 mm. longa. *Petala* lanceolata, obtusa, 2·5 cm. longa, 6 mm. lata, pubescentia ; interiora latiora, costis elevatis e basi ad $\frac{1}{3}$ longitudinis currentibus. *Stamina* brevia, 5-seriata, appendicibus angulatis complanatis pallidis. *Styli* hirti. *Ovula* circiter 11 (ex *Haviland*). *Carpella* matura 4, ovoidea vel oblonga, 1·5 cm. longa, 1 cm. lata, stipitibus 6 mm. longis.

Sarawak. Kuching, *Haviland*, 1779.

"Petals at first pale then claret colour."

674. **Goniothalamus parallelovenius**, *Ridl.* [Anonaceae] ; species *G. uvarioidi*, King, ut videtur affinis, foliis magnis oblongis iis *G. Curtisii*, King, similibus, floribus quam in *G. uvarioide* multo majoribus, petalis interioribus longioribus.

Folia magna, oblonga, basin versus paullo angustata, apice cuspidata, obtusa, basi rotundata, tenuia, coriacea, glabra, nervis 36-jugis parallelis subtus conspicue elevatis intra marginem arcuatis, costa convexa. *Flores* magni ; pedicelli validuli, 2·5 cm. longi. *Sepala* coriacea, triangularia, obtusa, 6 cm. longa, basi 5 mm. lata. *Petala* exteriora coriacea, anguste lanceolata, acuminata, obtusa, 6·5 cm. longa, 1 cm. lata, basi dilatata 5 mm. longa, minute farinoso-hirta ; petala interiora late lanceolata, basi angustata, obtusa, 4 cm. longa, 1·2 cm. lata. *Stamina* angustata, linearia, 3 mm. longa, appendicibus angustis conicis erectis scabris.

Sarawak. *Beccari*, 3772.

I have only seen a single flower and leaf of this species, but it seems very distinct from any other.

675. **Mitrephora rufescens**, *Ridl.* [Anonaceae] ; arbor parva rufo-hirta, *M. longipetalae*, Miq., e descriptione affinis, petalis autem multo minoribus exterioribus ovatis interioribus ungue lineari apice reniformi, nec ut in *M. longipetala* lineari-lanceolato et pollice parum longiore.

Arbor parva, circiter 5 m. alta, ramis petiolis nervis et partibus juvenilibus rufo-hirtis. *Folia* elliptica ad lanceolata, acuminata, basi rotundata vel breviter cuneata, 16–20 cm. longa, 5 8 cm. lata, tenuiter coriacea, superne in statu adulto glabra ; petioli 5 8 mm. longi. *Flores* in racemos rufo-hirtos perbreves dispositi ; singulatim aperti ; bracteae ovatae, persistentes. *Sepala* ovata, acuta, rufo-hirta. *Petala* exteriora ovata, acuta, 1 cm. longa, 5 mm. lata, extus sericea, intus glabra ; interiora ungue lineari, apice dilatato reniformi, extus pubescentia, limbo intus sericeo. *Stamina* copiosa, glabra, appendicibus semiglobosis rotundatis.

Sarawak. *Beccari*, 1616 ; Matang, *Haviland*, 1035 ; Bau, on limestone, *Haviland*, 2249.

Sumatra. Sungei Buluk Padang, *Beccari*, 916, 968.

676. **Oxymitra linderifolia**, *Ridl.* [Anonaceae] ; frutex glaber, *O. glaucae*, Hook. f. et Thoms., affinis, foliis coriaceis, nervis pauciori-bus, petalis latioribus differt.

Frutex glaber. *Folia* coriacea, superne brevia, subtus glauca, elliptica, cuspidata, acuta, basi rotundata aut breviter cuneata, 15–18 cm. longa, 6–8 cm. lata nervis 6-jugis subtus elevatis, costa convexa superne depressa; petioli 1·1 cm. longi. *Flores* singuli, in pedicellis extra-axillaribus 1 cm. longis; bractea mediana, brevis, lanceolata. *Sepala* pugioniformia, basi lata, apice angustata, 4 mm. longa. *Petala* exteriora lanceolata, linearia, pubescentia, 9 mm. longa, 3½ mm. lata; petala interiora conum angustum formantia, 5 mm. longa. *Torus* minimus, hirtus. *Pistilla* conica, hirta. *Ovula* 1–2, superposita. *Carpella* matura globosa, 5 mm. longa, stipitibus aequilongis.

Sarawak. Kuching, *Haviland*, 3333; *Haviland and Hose*, 3335.

The latter specimens, which are in fruit, have smaller leaves but appear to belong to the same species as the flowering ones.

677. **Melodorum fagifolium**, *Ridl.* [Anonaceae]; species *M. litseaefolio*, King, affinis, foliis haud tomentosis sed furfuraceis, paniculis brevibus, staminibus paucis, appendicibus rotundatis haud rostratis differt.

Frutex scandens, glabrescens, ramis rufo-furfuraceis. *Folia* ovata vel elliptica aut oblonga, apice cuspidata, basi rotundata superne parce furfuracea, subtus magis furfuracea, pallida, 7–10 cm. longa, 4–5 cm. lata, nervis 9-jugis superne inconspicuis subtus prominulis haud arcuatis; petioli atri, rufo-furfuracei, 1·5 cm. longi. *Paniculae* breves, subterminales, laxae, 7 cm. longae, furfuraceae; bracteae parvae, 1 mm. longae, lanceolatae, ovatae; pedicelli 7 mm. longi. *Alabastra* longe conica, triquetra, obtusa, acuminata. *Sepala* ovata, 2 mm. longa. *Petala* exteriora lanceolata, extus rufo-furfuracea, 1 cm. longa; petala interiora breviora, lanceolata, glabra. *Stamina* in verticillis 4, appendicibus rotundatis planis haud rostratis convexis glabris. *Pistilla* pauca, hirta.

Sarawak. Entagut River, *Hose*, 397.

678. **Melodorum paniculatum**, *Ridl.* [Anonaceae]; species *M. litseaefolio*, King, proxima, floribus majoribus, tomento partium juvenilium costae foliorum (subtus) et inflorescentiae rufo, staminibus paucis oblongis, appendicibus subtriangularibus rostratis distincta.

Frutex, partibus juvenilibus ferrugineo-tomentosis. *Folia* elliptica, acuminata, basi rotundata, coriacea, superne glabra costa media excepta, subtus rufo-tomentosa, 9–11 cm. longa, 2·5–5 cm. lata, nervis 11–12-jugis subtus prominulis; petioli validi 5 mm. longi. *Inflorescentia* terminalis, paniculata, 9–14 cm. longa, ramis 5 cm. longis, omnino rufo-tomentosa; bracteae lanceolatae, acutae, 1 mm. longae; pedicelli 1 cm. longi. *Alabastra* ovoidea. *Sepala* ovata, triangularia, 2 mm. longa. *Petala* exteriora ovata, subcuminata, obtusa, extus rufo-hirta, intus pallide tomentosa; petala interiora subaequilonga, crassa, carinata, apice fugaciter hirta. *Stamina* oblonga, pauca, appendicibus subtriangularibus rostratis lucidis brunneo-olivaceis. *Carpella* pauciora, pilis rufis longis tecta, apice glabra.

Sarawak. Kuching, *Haviland*, 1845.

679. **Melodorum rigidum**, *Ridl.* [Anonaceae]; scandens, foliis coriaceis laevibus nec tomentosis, calyce integro nec lobato gamophyllo, floribus singulis axillaribus insignis.

Frutex scandens, ramis nigris. *Folia* coriacea, elliptica, cuspidata, basi rotundata, 9–11 cm. longa, 3–4 cm. lata, supra laevia, costa depressa, nervis multijugis in utroque latere valde inconspicuis, subtus rufo furfuracea; petioli 1 cm. longi. *Flores* singuli, axillares; pedicelli rufo-furfuracei, 6 mm. longi. *Calyx* cupuliformis, integer, haud lobatus. *Petala* exteriora lanceolata, obtusa, basi latiora, superne attenuata, rufo-tomentosa, 1·5 cm. longa, ad basim 4 mm. lata; petala interiora multo breviora. *Carpella* matura cylindrica, obtusa, paullo ad basim angustata, 3 cm. longa, 2 cm. lata, tenuiter rufo-brunneo-velutinosa. *Semina* 7 atro-brunnea, lucida.

Sarawak. Kuching, *Haviland*, 421; *Beccari*, 393.

680. **Melodorum longipetalum**, *Ridl.* [Anonaceae]; species *M. fulgenti*, Hook. f., proxima, sed folia multo coriacea et laevia petala elongata, lineari-lanceolata, longiora.

Frutex ramis gracilibus, juvenilibus rufo-tomentosis. *Folia* lanceolata, acuminata, acuta, basi rotundata, supra glabra (sicca grisea), subtus glaucescentia, glaberrima costa rufo-tomentosa exepta, nervis supra inconspicuis subtus magis conspicuis in juvenilibus pilis tenuibus nitidis tectis, 6–7 cm. longa, 3 cm. lata; petiola 1 cm. longi, juventute rufo-tomentosi, adulti rufo-furfuracei. *Flores* siuguli, axillares; pedicelli 2 cm. longi, aut breviores; bracteae parvae, lineares. *Sepala* lanceolata, acuminata, 3 mm. longa. *Petala* exteriora lineari-lanceolata, acuminata, extus tenuiter rufo-tomentosa, intus glabra, 2·5 cm. longa, 4 cm. lata; petala interiora duplo breviora, linearia, acuminata, glabra. *Carpella* in toro cylindrico pilis sericeis flavis tecto.

Sarawak. Kuching, *Haviland*, 2102.
" Flowers sweet-scented."

681. **Melodorum ovalifolium**, *Ridl.* [Anonaceae]; frutex scandens, foliis parvis 5 cm. longis ovatis peltatis basi glandulis 2 instructis coriaceis glabris, floribus singulis extra-axillaribus, petalis longis angustis, staminum appendicibus elongatis quasi rostratis.

Frutex scandens, ramis tomentosis. *Folia* parva, ovata vel elliptica, breviter acuminata, obtusa, basi lata, peltata, glandulis elevatis 2 basalibus, 5 cm. longa, 2·5 cm. lata coriacea, superne glabra costa excepta, subtus glauca, nervis pilis rufo-tomentosis tectis; petioli pubescentes, 4 mm. longi. *Flores* singuli, foliis oppositi; pedicelli tenues, hirti, 2·5 cm. longi; bracteae minutae. *Sepala* ovata, obtusa, rufo-hirta, 2 mm. longa. *Petala* exteriora 2·5 cm. longa, basi 4 mm. lata, superne subabrupte angustata, linearia, obtusa, rufo-hirta; petala interiora brevissima, lanceolata, glabra, acuminata, 5 mm. longa. *Stamina* appendicibus prolongatis medio depressis.

Sarawak. Kuching, *Haviland*, 3141, 3151.

This I think is certainly a *Melodorum*, though in many points it resembles *Xylopia*, for the specimens show that it is clearly a climber. The peltate leaves with two basal glands are very peculiar.

682. **Xylopia congesta**, *Ridl.* [Anonaceae]; species *X. Scortechinii*, King, affinis, sed foliis floribusque minoribus, floribus congestis in massis parvis in ligno vetusto, petalis exterioribus et interioribus subsimilibus differt.

Frutex glabrescens. *Folia* lanceolata, breviter acuminata, basi breviter angustata, 8–9 cm. longa, 3·5 cm. lata, tenuiter coriacea, supra glabra costa depressa obscure pubescente excepta, nervis 11-jugis parce pubescentibus, nervulis invisis ; petioli 5 mm. longi. *Flores* congesti, e nodis ligni vetusti ; pedicelli 1 cm. longi, pubescentes. *Sepala* 1 mm. longa, rotundata, pubescentia. *Petala* exteriora e basi latiore linearia, 3 cm. longa, 1 mm. lata ; petala interiora similia, vix pubescentia. *Stamina* copiosa, appendicibus irregulariter rotundatis medio depressis. *Pistilla plura.*

Sarawak. *Beccari*, 2654.

683. **Xylopia coriifolia**, *Ridl.* [Anonaceae] ; arbor foliis ellipticis vel obovatis crasse coriaceis nitidis glabris, floribus paucis in massis extra-axillaribus, carpellis maturis cylindricis elongatis eis *X. ferrugineae*, Baill., similibus.

Arbor ramis validis. *Folia* elliptica, apice obtusa, vel obovata, basi angustata, 11–13 cm. longa, 4–5 cm. lata, valde coriacea, nitida, glabra, nervis in utraque pagina inconspicuis 7–8-jugis intra marginem anastomosantibus, nervulis secundarii fere aequalibus : petioli validi, 5 mm. longi. *Flores* pauci, extra-axillares, 2–3-ni ; pedicelli 1 cm. longi. *Sepala* ovata, acuta, glabra, 2 mm. longa. *Petala* lanceolata, acuta, sericea. *Carpella* matura cylindrica, basi angustata, 6 cm. longa, 7 mm. lata, stipitibus 1·5 cm. longis.

Sarawak. Kuching, *Haviland and Hose*, 3337 ; *Hose*, 1906 ; *Beccari*, 2652, 3335.

The flowers in all the specimens are very young.

684. **Xylopia Havilandii**, *Ridl.* [Anonaceae] ; arbor magna, *X. ferrugineae*, Baill., affinis foliis rigide coriaceis, sepalis connatis lobis brevibus, carpellis maturis obovoideis distincta.

Arbor magna, alabastris cupreo-hirtis. *Folia* rigide coriacea, lanceolata, utrinque attenuata, apice subacuta, 6–7 cm. longa, 2–3 cm. lata, glabra nisi costa pilis adpressis tecta, supra fusca, subtus rufo-glaucescentia (in sicco) ; petioli canaliculati, 0·5–1 cm. longi, lamina ad basin decurrente. *Flores* plurimi, in axillis racemosi, 3–4 in nodo ; pedunculi adpresse hirti, 1 cm. longi ; bracteae ovatae. *Sepala* connata, lobis ovatis acuminatis adpresse hirtis 3 mm. longis. *Petala* exteriora linearia, acuminata, basi rotundata, adpresse hirta, 1·6 cm. longa ; petala interiora angustiora, linearia, subaequilonga. *Stamina* longiuscula, linearia, appendicibus parvis conicis. *Pistilla* rufo-hirta, stylo longo glabro. *Carpella* (vix matura) obovoidea, apice rotundata, basi angustata, 2 cm. longa, 7 mm. lata.

Sarawak. Kuching, *Haviland and Hose*, 3352 ; *Haviland*, 2334.

"Petals yellow ; ovules numerous."

685. **Xylopia pulchella**, *Ridl.* [Anonaceae] ; species *X. rubellae*, Pierre, planta cochin-chinensi, affinis foliis parvis rotundatis, sepalis connatis, petalis subaequilongis angustis, staminum appendicibus parvis conicis distincta.

Arbor (vel frutex) glabra. *Folia* ovata, obtusa, rotundata vel paullo angustata, 4–5 cm. longa, 3–3·5 cm. lata, laevia (in sicco grisea, subtus rufo-brunnea), nervis utrinque 6–7, in pagina utraque inconspicuis ; petioli 5 mm. longi. *Flores* singuli, extra-axillares ;

pedicelli 5 mm. longi. *Calyx* gamosepalus, glaber, 2 mm. longus, dentibus 3 brevibus. *Petala* exteriora lanceolata, basi dilatata, 1·2 cm. longa, flava, pubescentia ; petala interiora multo angustiora, linearia, fere aequilonga, basibus rubris. *Stamina* plurima, gracilia, appendicibus conicis parvis rubris (ut in *X. obtusifolia*). *Styli* longi ; glutinosi (fide *Haviland*).

Sarawak. Kuching, *Haviland*, 2101.

686. **Xylopia lanceola**, *Ridl.* [Anonaceae] ; species *X. caudatae*, King, valde affinis, floribus multo majoribus, petalis multo longioribus, foliis saepe multo majoribus distincta.

Arbor ramis gracilibus. *Folia* lanceolata vel elliptica, acuminata, obtusa, basi rotundata, 1·5–5 cm. longa, 2 cm. lata, subtus sericeo-pubescentia, costa pagina utraque pilis adpressis tecta, nervis valde inconspicuis ; petioli 2 mm. longi. *Flores* singuli vel bini ; pedicelli brevissimi. *Calyx* gamosepalus, 2 mm. longus, lobis brevibus. *Petala* exteriora anguste linearia, basi latiora, 6 mm. longa, 1 mm. lata, minute adpresse hirta. *Stamina* linearia, appendicibus minutis. *Pistilla* pauca, sericeo-hirsuta.

Sarawak, *Beccari*, 1908, 3368.

687. **Mezzettia pauciflora**, *Ridl.* [Anonaceae] ; species *M. umbellatae*, Beccari, affinis, sed petalis brevioribus, floribus paucis racemosis, foliis rigide coriaceis lanceolatis acuminatis, fructu olivaeformi differt.

Folia lanceolata, longe acuminata, basi cuneata, 11–14 cm. longa, 3·5–4 cm. lata, coriacea, subtus pallida, nervis 6-jugis intra marginem arcuatim anastomosantibus, costa prominente, reticulationibus laxis pagina utraque conspicuis ; petioli 5 mm. longi. *Flores* pauci, racemosi ; pedunculi 1 cm. vel minus longi, extra-axillares ; pedicelli 5 mm. longi, coerulei (ex *Haviland*). *Sepala* ovata, parva, viridia. *Petala* e basi latiore linearia, 5 mm. longa, sordide alba (ex *Haviland*), interiora minora. *Stamina* quadrata, truncata, apice plana. *Ovarium* 1-ovulatum. *Carpellum* maturum 1, cylindricum, obtusum, olivaeforme, 4 cm. longum, 2 cm. latum glaucum (ex *Haviland*). *Semen* ellipsoideum, 2·5 cm. longum.

Sarawak. Kuching, *Haviland*, 1952.

688. **Mezzettiopsis**, *Ridl.* [Anonaceae] ; genus novum *Mezzettiae*, Becc., affine, forma staminum, petalis exterioribus brevibus latis rotundatis distinctum.

Arbor habitu *Mezzettiae*, Becc. *Folia* tenuiter coriacea, oblonga, breviter petiolata. *Flores* copiosi, parvi, ex axillis foliorum paniculati hirti. *Sepala* parva, ovata, libera. *Petala* exteriora brevia, late rotundata, ovata ; petala interiora longiora, linearia, obtusa, crassiuscula, basi excavata. *Stamina* plura, elliptica, loculis latis apice angustatis acutis. *Pistilla* 6 vel plura, curva, stylo brevi. *Ovulum* 1, basale.

Mezzettiopsis Creaghii, *Ridl.* ; species unica.

Arbor ramulorum cortice nigro. *Folia* elliptica, breviter obtuse cuspidata, basi angustata, 12 cm. longa, 4 cm. lata, nervis utrinque 6 subtus elevatis intra marginem anastomosantibus, omnino glabra ; petioli 3 mm. longi. *Flores* parvi in paniculas breves hirtas 2 cm. longas dispositi ; bracteae ovatae, hirtae, 1 mm. longae. *Sepala*

minima, ovata, hirta. *Petala* exteriora brevia, late rotundata, ovata, hirta; petala interiora linearia, obtusa, 5 mm. longa, crassa, subcarnosa, hirta, basibus excavatis androecium tegentibus. *Stamina* circiter 20, elliptica, apice cuspidata, 2-locularia. *Carpella* 6 vel plura, stamina vix superantia, stylis brevibus obtusis. *Ovulum* 1, basale.

British North Borneo. Tinkayo, *Creagh.*

This plant seems certainly allied to *Mezzettia* of which it has much the habit. The stamens have, however, the form of those of *Alphonsea*. It differs from every genus known to me in the short, broad, rounded outer petals which are much shorter than the inner ones, in the form of the stamens and in the numerous pistils with solitary basal ovules.

689. **Dalbergia maymyensis**, *Craib* [Leguminosae-Dalbergieae]; ab affini *D. assamica*, Benth., stipulis linearibus, foliolis paucioribus, paniculis minoribus, racheos pedunculi ramulorumque juvenilium indumento rufo-tomentoso facile distinguenda.

Arbor mediocris (ex *Lace*); ramuli primo rufo-tomentosi, mox glabri, cortice fusco obtecti. *Folia* cum floribus coetanea, ad 12 cm. longa, 3–10-foliolata, petiolo ad 2 cm. longo suffulta, petiolo rachi petiolulisque primo rufo-tomentosis mox breviter crispatim albido-pubescentibus; stipulae lineares, 2 mm. longae, 0·75 mm. latae, cito deciduae; foliola alterna, ovato-elliptica vel elliptico-oblonga, apice parum retusa, basi terminalia cuneata, lateralia parum inaequalia, cuneata vel rotundata, ad 4·3 cm. longa, 2·1 cm. lata, rigida, juventute utrinque adpresse pubescentia, mox utrinque tenuiter pilosa, nervis lateralibus utrinque 6–8 cum nervis transversis pagina superiore prominentibus inferiore conspicuis, petiolulis ad 4 mm. longis suffulta. *Paniculae* axillares, ad 3·5 cm. diametro, pedunculo communi 3–4 cm. longo ut ramuli rufo-tomentoso suffultae; bracteae bracteolaeque deciduae; pedicelli 2 mm. longitudine vix attingentes. *Calycis* tubus 2 mm. longus; lobus infimus lanceolatus, acutiusculus, 2·5 mm. longus, 1·25 mm. latus; lobi laterales oblongi, obtusi, circiter 1·5 mm. longi et lati; lobi infimi basi connati, circiter 2 mm. longi et lati. *Vexillum* reflexum, orbiculatum, circiter 6 mm. diametro; alae 6 mm. longae, 3·5 mm. latae, basi breviter auriculatae; carina circiter 3·75 mm. longa et 2·75 mm. lata; petalorum omnium ungues circiter 1·5 mm. longi. *Stamina* isodiadelphia. *Ovarium* 4 mm. altum, 4-ovulatum, stipite 1·5 mm. longo suffultum, suturis pubescens; stylus cylindricus 1·5 mm. longus, stigmate parvo capitato. *Legumen* samaroideum, plerumque late ligulatum, apice acutum, basi in stipitem attenuatum, ad 7 cm. longum et fere 1·5 cm. latum, glabrum, tenuiter reticulatum nisi umbone distincte reticulatum, 1- vel 2-spermum, stipite ad 8 mm. longo suffultum.

Indo-China. Upper Burma: Maymyo Plateau, 1050 m., *Lace*, 3113, 4134, 5793, 5848; Mu River, *Smales*.

690. **Sedum Woodwardii**, *N.E.Brown* [Crassulaceae]; affinis *S. Aizoo*, Linn. sed foliis obovatis obliquis obtuse dentatis et cymis majoribus laxioribusque differt.

Herba perennis, ubique glabra. *Caules* circa 30 cm. alti, simplices, 5 mm. crassi, leviter pluri-angulati, virides. *Folia* alterna, laxa, 3·5–6 cm. longa, 2–3 cm. lata, oblique cuneato-obovata, obtusa,

superne irregulariter et obtuse dentata, inferne longe cuneato-angustata, tenuiter carnosa, viridia. *Cyma* 7–9 cm. diametro, subplana, 2–5-ramosa ; rami dichotomi, sublaxi, bracteati, virides. *Bracteae* inferiores magnae, foliiformes, ceterae multo minores 0·8–2·5 cm. longae, 3–10 mm. latae, oblique cuneato-oblanceolatae, acutae vel obtusae, integrae. *Flores* 5–10 mm. sejuncti, sessiles, 1·3 cm. diametro. *Sepala* 4–5 mm. longa, lineari-subulata, obtusa, carnosa, viridia. *Petala* 5, stellatim radiata, 7 mm. longa, 2 mm. lata, lanceolata, acuta, lutea. *Stamina* 10, erecta, lutea. *Carpella* arcte contigua, erecta, pallide lutea.

The origin of this plant is not known with certainty. It was sent to Kew for name on Sept. 24, 1912, by Mr. Robert Woodward, Junior, of Arley Castle, with the statement that it had appeared in a bed with some seedlings of a species of *Sambucus*, of which the seeds were collected in the Rocky Mountains, near Glacier, on Sept. 3, and sown on Nov. 11, 1911, germinating in May, 1912. As the *Sedum* is stated to have a rather woody root-stock with many short shoots, it seems scarcely credible that it is only of four months' growth from seed. There is just a possibility, however, that it may be a stray seedling from a bed about 3 yards away, where seedlings of Wilson's 1910-1911 Chinese collection are growing. This latter assumption seems more probable, because there is no species nearly allied to it known from North America, whilst its nearest ally (*S Aizoon*, L.), is a native of Northern Asia. *Sedum Woodwardii*, however, is not represented among Wilson's dried plants at Kew.

LIV.—THE SOURCE OF SIAM BENZOIN.

(*Styrax benzoides*, Craib).

The lack of information as to the source of Siam benzoin has been pointed out at various times in the Pharmaceutical Journal by Mr. E. M. Holmes and in response to his application for assistance to trace the origin of the product Dr. Kerr was communicated with on the subject. We are much indebted to Dr. Kerr for his kind reply to our enquiry from which we have extracted the following interesting information.

The *Styrax* tree which grows on Doi Sootep and which is fairly common at 600-1200 m. altitude in evergreen jungle, particularly in that type of forest where *Quercus Junghuhnii* predominates and where the soil consists of a stiff red clay overlain by a thick layer of humus, was, from flowering material only, believed to be *S. Benzoin* (*Kew Bull.* 1911, p. 409). The receipt of fruiting specimens showed, however, that it was not *S. Benzoin* but a new species closely allied to *S. suberifolius* and since described as *S. benzoides* (*Kew Bull.* 1912, p. 267). *S. benzoides*, on Doi Sootep, grows rapidly and attains a height of 12–15 m. and a girth of about 9 dm. but most of the trees are smaller though in other parts larger trees are reported. Several Kamus, natives of the Luang Prabang region from which most of the gum comes, have, without a leading question, identified the Doi Sootep tree as ton kŭm yan, kum yan being the Lao and Siamese name for gum benzoin. It

must be admitted that small specific differences might not be noted by the natives though they are often acute observers of such points particularly where economic plants are concerned.

Dr. Kerr's belief that this tree is the source of the Siamese gum benzoin has been confirmed by the receipt at Kew of a small sample of the gum collected from the Doi Sootep trees which in smell, taste and fumes is identical with commercial Siamese gum benzoin. Though the gum is only casually collected in the Chiengmai district yet nearly every tree examined on Doi Sootep had been notched and in some cases completely felled. In the majority of cases the cuts were very old and on most trees no gum at all was observed but on a few there was a small incrustation of gum along the cuts. The largest piece of gum obtained weighed about 2·5 grammes and was found in a hole made by some wood-borer. It was a homogeneous, transparent, pale amber piece with the characteristic odour of Siam benzoin.

The principal method of collecting the gum is by making V-shaped incisions through the bark. The gum runs slowly into bamboo joints placed at the bottom of the V and is not collected until a few weeks after the incision is made. This is generally done during the hot season. Gum is also frequently found in holes made by wood-borers and sometimes on or in the ground at the foot of the trunk. The quality of the gum is the same by whatever method it is collected. Whether any particular tree will yield gum or not can only be ascertained by tapping as only the larger trees and not even all of them yield gum.

None of the gum obtained near Chiengmai is exported, but nearly all of it is used locally, mixed with pig's fat, as an application for the hair. Most of the gum which reaches Chiengmai is brought there by the Kămus during the cold season from the Luang Prăbang region to the East of the Mê Kong. A native merchant buys it and ships it to Bangkok. This merchant estimates his yearly purchases at 5 sens (approximately 10 cwt.), but for the last two years the quantity has been less because, he says, it no longer pays the Kămus to collect it and bring it down. Although the merchant had heard that the tree grew on Doi Sootep he had never bought gum from any district but Luang Prăbang.

Gum benzoin is also brought to Korat in Lower Siam but no information as to its source is available.

LV.—MISCELLANEOUS NOTES.

Mr. F. A. Stockdale.—We learn that Mr. F. A. Stockdale, Assistant Director of the Department of Science and Agriculture and Government Botanist, British Guiana, has been appointed Director of Agriculture, Mauritius.

Mr. Walter Victor North, a member of the gardening staff of the Royal Botanic Gardens, has been appointed by the Secretary of State for India in Council, on the recommendation of Kew, a probationer gardener for service in India.

Dr. M. C. Cooke.—In consequence of the announcement in the Journal of Botany for September, 1912, p. 296, which we read with deep regret, of the death of our former colleague, Dr. M. C. Cooke, a notice of his life and scientific work appeared in the last number of the *Kew Bulletin*. It gives us much pleasure to learn from Dr. Cooke himself that he is in excellent health.

John Davies Enys.—We notice with regret the announcement of the death of Mr. J. D. Enys of Enys, Penryn, Cornwall, an old and valued correspondent of Kew. Mr. Enys, who was born in October, 1837, was the representative of a family which has been seated at Enys since the time of Edward I. He resided for many years in New Zealand, where he was a magistrate from 1865 to 1891, and no doubt to his long connection with that Colony must be attributed his interest in the New Zealand Flora.

A brief account of the garden at Enys was given in *Kew Bulletin*, 1893, p. 357, and note is made of some of the interesting New Zealand plants cultivated there. Among them were plants of *Fagus Solandri* (not *F. Cunninghamensis* as stated in *Kew Bulletin*) which Mr. Enys brought back to Cornwall from New Zealand. Among other interesting introductions may be mentioned *Fagus Cliffortioides*, a species growing at an altitude of about 2500 feet between Christchurch and Hokitika, plants of which were sent to Kew by Mr. Enys in 1888. One of his first gifts to Kew was the very fine specimen of the New Zealand sheep plant *Raoulia mammillaris*, now in Museum No. I., which he sent over to England in 1881.

Among horticulturists he is renowned for the introduction and successful culture of the Chatham Island Forget-me-not, *Myositidium nobile*. In a letter to Kew in 1894 he wrote that the leaves of his plants at Enys were nearly 18 inches across, of a vivid green, and nearly 3 feet high.

Another tie with Kew lay in the fact that he was a cousin of Miss Marianne North.

He died on November 7th at Leeds, where he had gone to undergo an operation.

Propagation of Rhamnus Purshiana (Cascara Sagrada).—In an article on Cascara Sagrada which appeared in the *Kew Bulletin*, 1908, p. 429, the question of the tree proving a remunerative culture in parts of the British Isles was discussed. With a view to having the tree tested in quantity two separate consignments of seeds were obtained from North America and distributed amongst a number of gardens in various parts of Great Britain and Ireland. Unfortunately, the greater part failed to germinate. As the few trees already in cultivation do not bear seed in great abundance, it was desirable to find out if the tree could be increased by cuttings. A considerable quantity have been put in at various seasons, from the soft cuttings of young wood in June, to autumn cuttings in gentle heat and leafless cuttings in cold frames in early winter.

The autumn and winter cuttings have hitherto been complete failures and the greatest success has been secured with those made of younger wood. In June some cuttings made of the new shoots were put in mild bottom heat in a close frame ; they were three or four inches long with a "heel" of older wood at the base, and 50 per cent. took root. In early July, when the wood had, of course, become firmer, a second batch of similar cuttings was put in under the same conditions ; of these about 85 per cent. took root. From present experience, therefore, it would seem that July is the best month to take cuttings. Vegetation in the earlier part of the summer of 1912 was considerably in advance of the normal, so that in early July the shoots would be about as far advanced as, in ordinary years, they are in mid or late July. With a little more practice and knowledge of those small particulars in the selection, making and treatment of the cuttings—on which, as propagators know, success so much depends in the case of plants like the present, not among the easiest to deal with—it seems likely that we may expect to get an almost perfect "strike" of July cuttings.

W. J. B.

Botanical Magazine for November.—The plants figured are *Eriopsis Helenae*, Kränzl, (t. 8462) ; *Mesembryanthemum Pearsonii*, N. E. Brown (t. 8463) ; *Cornus controversa*, Hemsl. (t. 8464) ; *Iris caroliniana*, S. Wats. (t. 8465) and *Corokia virgata*, Turrill (t. 8466).

We are indebted to Messrs. Sander & Sons for the introduction of *Eriopsis Helenae* to cultivation. The genus which is wholly South American contains only six species. The subject of the illustration is a native of Peru and flowered at Kew for the first time in 1909 ; the plant having been presented by Messrs. Sander in 1894. The description was drawn up by Kränzlin from a specimen which flowered at St. Albans in 1897. The flower scapes, some 60 cm. long, with their numerous yellowish-brown flowers are very striking.

Mesembryanthemum Pearsonii is one of this remarkable group of South African plants with a single pair of leaves and shows considerable resemblance to *M. testiculare* and *M. Bolusii*. The leaves, however, are much larger than those of the former species and from the latter it differs particularly in having no style but a large sessile discoid stigma. The plant which forms the subject of the illustration was collected during the Percy Sladen Expedition to the Orange River and sent by Prof. H. H. W. Pearson to Kew in 1911 where it flowered shortly afterwards.

The *Cornus* is one of the most elegant of small deciduous trees in cultivation. The leaves are alternate, though this is not very clearly shown in the figure, and in this respect it differs from all other species except *C. alternifolia*, Linn. The plant figured was obtained from Messrs. J. Veitch & Sons. The confusion which has arisen in connection with this species and *C. brachypoda* has been dealt with under *C. macrophylla*, Wall. (t. 8261). *C. controversa* is a native of the Himalaya and Eastern Asia.

Iris caroliniana is an interesting species from Virginia and Carolina and was first discovered by Mr. W. A. Manda in North Carolina. It was described by the late Mr. S. Watson from a specimen which flowered in the Harvard Botanic Gardens. The species is closely allied to *I. versicolor*, Linn., but can easily be distinguished by its larger lavender-coloured flowers and green leaves. The plant figured was raised from seeds presented to Kew by the Missouri Botanic Gardens in 1908 but the species had been in cultivation at Kew for some ten years previously.

The *Corokia* figured at t. 8466 has been in cultivation at Kew since 1907 when it was raised from a cutting sent to Kew by the Editor of the Gardeners' Chronicle. It is nearly allied to *C. Cotoneaster* but can be distinguished especially by the larger leaves and scarcely tortuous branches. Only three other species have been described and our plant may be identical with one noted by Mr. Cheeseman in New Zealand, without flowers, in which the branches were not tortuous and the leaves were similar to those of the species illustrated.

Opuntias in the Canary Islands.—Whilst spending some months in the Canary Islands I took the opportunity to study the various species of Opuntia growing there, and noticed the following species in Grand Canary and Teneriffe :—

1. *Opuntia brasiliensis*, Haw. In a garden at Orotava, Teneriffe. Lowe records this in his "Flora of Maderia," as having been introduced into that island, but he does not state if it had become wild or not, in his time.

2. *Opuntia Ficus-indica*, Webb and other writers, but not the true *O. Ficus-indica* = *O. Tuna* of some writers. This plant Webb called *Opuntia Ficus-indica*, in his "Histoire Nat. des Iles Canaries," iii., 1840, p. 208, stating that it has two varieties :—

   α. spinosa, with yellowish-white spines.

   β. inermis aut parce spinosa, unarmed or nearly so.

   It is also the plant which was collected and distributed by Bourgeau under his No. 1239, with the name of *Cactus Ficus-indica*, and is called *O. Ficus-indica* by Pitard and Proust—"Les Iles Canaries," 1909, p. 197. It is certainly not the *O. Ficus-indica* of the coast regions of the Mediterranean, nor the true *Cactus Ficus-indica*, L.

   It appears to have been the plant used principally for the Cochineal industry, and is still extensively cultivated at Arucas, in Grand Canary, for this purpose. Where grown for rearing and feeding the Cochineal insect it rarely seems to flower and fruit, but elsewhere—on abandoned cochineal plantations—its rich orange flowers, turning to pink as they fade, are abundantly produced and the fruit is eaten in considerable quantity.

   The thorns of this Opuntia are short and white, generally two or three together, but in old plants often single, or almost entirely absent.

3. *Opuntia Dillenii*, Haw. Very common close to the sea in Grand Canary, and used for hedges in Teneriffe. This is the *O. Tuna* of Webb and of Bourgeau No. 263, and also of Pitard and Proust.

   The spines of this plant are used in the cochineal industry to pin on the rags that protect the insect.

4. *Opuntia monacantha*, Haw. Only found by me once in Grand Canary—probably in what had been a garden.
5. *Opuntia robusta*, Wendl. Cultivated, I believe, formerly for Cochineal, now allowed to grow in a wild state in Teneriffe for its fruit, which according to Schumann "Gesamtbeschreibung des Kakteen," p. 742, is considered in Mexico one of the best to eat.
6. *Opuntia tomentosa*, Salm-Dyck. In Teneriffe, but not very plentiful. On some plants I found Cochineal doing well.
7. *Opuntia* sp., from Grand Canary—a plant with rather long dark thorns, a specimen of which is now in cultivation in the Royal Botanic Gardens, Calcutta, as No. 33,924. It has not yet been identified.
8. *Opuntia* sp. Another species with straight spines from Teneriffe. A specimen of which is now in cultivation at the Royal Botanic Gardens, Kew.

M. Burkill.

Marram Grass for Paper-making.—Among other plants suggested as suitable for the Paper-maker which have recently been examined in this connection is the common Marram Grass of our coasts, *Ammophila arenaria*, Link.

This grass, as is well known, is grown on the sand hills around our shores and acts as a very valuable sand-binder. It now appears that it possesses quite useful qualities as a source of material for paper-making. Messrs. Clayton Beadle and Stevens have kindly examined a consignment of Marram Grass sent through Kew from the Norfolk sand hills. They inform us that the grass was boiled under pressure, without passing through crushing rollers, and then bleached. The figures for the yield of unbleached and bleached fibres, expressed on the original green weight of stem as received and on the dry weight, are as follows :—

	Green Stem.	Dry Stem.
Unbleached	17·7 per cent.	31·4 per cent.
Bleached	13·1 „	25·0 „

The average length of unbeaten fibres contained in the pulp taken on an average of ten measurements was found to be 0·65 mm.

Marram Grass is found to produce a soft pulp with a short tear which more nearly resembles in general feel and external appearance the pulp produced from Esparto or chemical aspen wood pulp.

The primary function of Marram Grass is of course as a sand-binder, but it is possible that should it be deemed of sufficient importance as a paper-making material its cultivation could be extended over considerable tracts of sandy country bordering the coast in various parts of the British Isles.